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Landsifier 2.0: Towards automating landslide trigger and failure movement identification

Lorenzo Nava[1], Kushanav Bhuyan[1], Manan Kapoor[2], Kamal Rana[2], Ascanio Rosi[1], Joaquin Vicente Ferrer[3], Ugur Ozturk[2], Mario Floris[1], Cees van Westen[4], and Filippo Catani[1]

[1]Machine Intelligence and Slope Stability Laboratory (MISSLab), Department of Geosciences, University of Padova, Padova, Italy

[2]Helmholtz Centre Potsdam – GFZ German Research Centre for Geosciences, Potsdam, Germany

[3]Institute of Environmental Science and Geography, University of Potsdam, Potsdam, Brandenburg, Germany

[4]Faculty of Geo-Information Science and Earth Observation (ITC), University of Twente, Enschede, Netherlands

Understanding landslide failure processes is pertinent to predict and minimize the effects of landslides. A variety of elements, such as geology, topography, and soil conditions, can lead to slope failures triggered via natural causes e.g., rainfall and earthquakes, setting off the failure movements. Proper geotechnical analysis requires knowledge of both the triggering event and the subsequent movement patterns of the landslide. This information is vital for accurately predicting when and where landslides might occur. To integrate this information into existing landslide inventories, we introduce Landsifier 2.0, a tool designed to meet the needs of the landslide research community. This Python-based library allows seamless usage of machine learning models to extract information regarding landslide triggers and failure movements solely based on inventories of landslides. Powered by topology, a high-dimensional feature extraction module encapsulated within our library, information accessed via a landslide's shapes and configurations allows the identification of triggers (e.g., earthquake-and rainfall-triggered landslides) and failure movements (e.g., rotational slides, translational slides, debris flows, rock falls) of undocumented landslide inventories through continuous remote sensing missions. We showcase the library's application in diverse geomorphological and climatic settings e.g., South-western China, Denmark, Turkey, Japan, Italy and more. We anticipate that Landsifier 2.0 will be particularly useful in the predictive modelling domain (including susceptibility and hazard modelling) of landslide studies, where precise information about triggers and failure dynamics is essential for developing reliable predictive models.

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